



Role Of Bat Guano In The Development Of Agricultural Ecoland-Ecosystem And Formulation Of Universal Bio-Compost

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Abstract:

This study aimed at assessing the microbial, physicochemical characteristics, and manure quality of guano of an insectivorous bat *Rousettus leschenaulti*. The role of bat guano in agricultural field was also assessed. Results indicated that organic matter, total carbon, total nitrogen and phosphate were high in humus guano. Calcium, magnesium, bacteria, actinomycetes and fungi were higher in humus guano. All characteristics of humus guano significantly differed than other animal guano. The results clearly indicated that incorporation of low amount of bat guano into the soil for enhances crop production and our investigation also reveals that bat guano act as a soil-builder, cleanser, activator, fungicidal, nematocidal, insecticidal and excellent organic compost. Importance of conservation of insectivorous bats in agricultural ecoland-ecosystem development and their guano have been emphasized.

Key words: *Rousettus leschenaulti*, insectivorous bat, bat guano, organic manure, crop production, ecoland-ecosystem.

INTRODUCTION

Although agricultural chemicals drastically increase food production, it leads to impaired soil health, depletion of organic matter and microbes and persistence of heavy metals and pesticides. Organic farming has been promoted to restore soil health and fertility status. Application of farmyard manure (FYM), compost, green manure and bioinoculants are the most important management practices in organic farming (Thampan, 1993).

Improvement of soil fertility through the application of vermicompost is becoming more popular. In contrast to chemical fertilizers, application of FYM meets one half of nitrogen, one sixth of phosphate and about one half of potassium requirements of crops during the first season.

On equivalent nitrogen basis, FYM or compost is 40-60% efficient as chemical nitrogenous fertilizers to increase crop production. Even though long-term (>5 years) application of organic manure overcome such disparity, efficient application of organic matter for self-sustenance in agriculture has not reached the farming community. Several organic manures of animal origin are available for use (e.g. night soil, bovine dung and urine, sheep manure, poultry manure, silkworm wastes and vermicompost). Availability of such manures for crop production is restricted due to many constraints such as geographical region, awareness of manure value, extent of manure production and management. There is ample scope to assess and utilize non-conventional organic manures in agriculture.

No other fertilizer possesses the qualities and properties of Bat Guano. It is the ultimate in Organic Fertilizer containing all the essential elements necessary to grow healthy plants. The word "guano" originated from the Quichua

language of the Inca civilization and means "**the droppings of sea birds**". Bat guano has been used in agriculture in many regions for hundreds of years. In the 1600s in Peru, the Incas valued guano so highly that the punishment for harming the animals that produced it was death. In 1856, The United States also recognized the value of guano, by passing an Act that gave protection to any citizen that discovered a source of guano. The discoverer was able to take possession of unclaimed land that contained guano, and was entitled to exclusive rights to the deposits. By the end of the nineteenth century, artificial fertilizers made guano less important. Now that the risks of synthetic gardening products are becoming widely known, more and more growers are realizing that this dark, rich manure is indeed one of nature's treasures, ably serving as plant fertilizer, soil builder, soil cleanser, fungicide, nematocide, and compost activator.

Features and Benefits:

Bat guano can be safely used as an organic fertilizer, both indoors and outdoors and will benefit vegetables, field crops, herbs, flowers, fruit and nut trees. Because guano is rich in bioremediation microbes, which help clean up toxic substances, it will act as a purifier in areas in transition from chemical to organic practices. Bat guano is the most highly refined organic fertilizer, guano starts out as plant life, and insects eat from the plant then fly into the air and are eaten by the bats. The bats droppings fall to the cave floor and then the guano beetles and decomposing microbes attack the bat droppings and use it as food. The result of this natural process is that guano contains powerful decomposing microbes, which help control soil-borne diseases.

Properties of Guano:

Bat guano contains all the macro and micronutrients that plants require in a natural

form whereas inorganic fertilizers are manufactured to have particular characteristics. This results in multiple applications of various inorganic fertilizers in order to remedy deficiencies that exist in the soil. Soil Builder - improves the texture of the soil, Soil cleanser - microbes help to clear any toxins in the soil, Fungicide - when fed to the plants through the leaves, Nematocide - decomposing microbes help control nematodes (worms) and Soil activator - microbes speed up the decomposition

Organic vs. Inorganic:

Proponents of organic farming maintain that the advantages of organic fertilizers are that it will not upset the natural balance of the soil in the applied area. What this means is that you can apply lots to the area, but only small quantities of the nitrogen and other useful minerals and elements will leach out of the soil.

Whereas with inorganic fertilizers there is considerable leaching of the soil and these elements end up in rivers and streams where the ecosystem is destroyed. A process called eutrophication, where the competition between plant life and fish life for oxygen results in the destruction of marine life and the growth of algae. The best example is to use is the destruction caused by DDT in the 1960's.

In essence guano as a fertilizer forms an integral part of organic farming which is the move away from the synthetic fertilizers and insecticides, favoring crop rotation over monoculture i.e. one crop farming in order to preserve or in many cases reestablish the biodiversity of farm.

There is a 10%-15% annual increase in the amount of agricultural land being converted to organic methods

Application of Guano:

Applied as a top dressing and worked into the soil or mixed with water and applied, guano will have a dramatic influence. Hydroponics growers, in contrast to normal fertilization, are finding that guano and water are a natural alternative to chemical solutions. Use nitrogen guano for growth, phosphorus guano for budding and all guano for your plants general health and well-being. Guano can be blended with topsoil before laying sod or grass seed and while planting trees and shrubs add guano to water dispenser.

Formulated guano - 10 mg to 1000 ml of water (1:100) mix well, sufficient for more than 100 acres.

Formulated guano - 1 mg to 1kg of soil (1:100) mix well and wet it, sufficient for more than 100 acres.

CONCLUSIONS AND OUTLOOK

Investigations on the possibilities of using nonconventional organic manures (e.g. vermicompost, millipede compost, bat guano) (Kale et al., 1992; Ashwini and Sridhar, 2002, 2006) in agriculture are becoming popular. Further studies are essential to investigate the occurrence of plant-promoting microbes in bat guano and their application in agriculture.

Production of seedlings of plantations in nurseries with sufficient vigor is an essential prerequisite than mass propagation of seedlings in the field. If bat swarming and roosting sites are preserved, their guano may become low cost natural manure for pot mixtures, gardens, nurseries, green houses and landscapes. Studies on the efficiency of combinations of insectivorous bat guano in crop production need to be addressed as they are rich in nitrogen and phosphorus respectively. Our investigation reveals that the bat guano act as a one of the universal organic compost because it has great immense properties like Soil Builder - improves the texture of the soil, Soil cleanser - microbes help to clear any toxins in the soil, Fungicide - when fed to the plants through the leaves, Nematocide - decomposing microbes help control nematodes (worms), Soil activator - microbes speed up the decomposition and insecticide - kill the pest.

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Table 1: Physico-chemical and microbiological characteristics of bat guano.

Characteristics	Other animal (rodents)	Humus guano
Fresh weight (kg/ m ²)*	2.8±0.3 (2.5-3.5)	5.8±0.2 (4.9-5.5)
Dry weight (kg/ m ²)*	2.6±0.2 (2-3)	3.9±0.4 (1.5-3.7)
pH	7.8±0.1 (7.4-7.6)	6.9±0.2 (6.2-6.8)
Conductivity (m mhos/ cm)	2.7±0.2 (2.5-3.1)	3.9±0.6 (2.8-4.8)
Organic matter (%)	78.3±5.2 (70.2-86)	81.6±15.5 (24-61)
Total carbon (%)	46±3.1 (38.7-46.9)	56.4±11.4 (12.5-45.4)
Total nitrogen (%)	7.9±0.7 (8.7-9.5)	5.7±1.5 (4.5-8.7)
C/N ratio	5.9±0.6 (6-7.9)	6.6±1.6 (2.9-7.8)
Phosphate (%)	2.4±0.3 (3-4)	2.2±1.1 (0.9-4.7)
Potassium (%)	1.12±0.1 (1-1.3)	2.9±0.3 (0.5-2.3)
Calcium (%)	1.2±0.1 (1-1.8)	2.5±0.4 (1.6-2.6)
Magnesium (%)	2.6±0.1 (2.9-3.9)	4.1±0.6 (2.9-4.7)
Bacteria (cfu/ g dry wt)	0.43±0.3x10 ⁷ (0.08-0.9)	1.22±0.7x10 ⁷ (3.5-4.5)
Actinomycetes (cfu/ g dry wt)	1.82±0.5x10 ³ (1.6-2.8)	9.98±5.9x10 ³ (4.8-24)
Fungi (cfu / g dry wt)	0.4±0.2x10 ⁵ (0.2-0.9)	5.1±1.4 x10 ⁵ (0.6-8.5)
Organochlorine compounds	Organochlorine,	Organophosphate, Carbamate componds and many more
Elements	108 elements reported	

(n = 5; mean ± SD; range in parentheses) *Accumulation in many years duration resulted into hip (humus) bat guano.

Table2: Comparison of N, P, K content in different animal wastes which are used as manures.

Manure	%N	%P	%K	Release speed
Cattle	0.5 to 2	0.2 to 0.7	0.4 to 2	Medium
Duck	2.6	0.8 to 1.4	0	Medium
Goat	4	0.6	1 to 2.8	Medium
Goose	3.3	0.4	0.6	Medium
Pig	0.4 to 2	0.5 to 1	0.4 to 1.2	Slow
Pigeon	6.3 to 6.5	2.5	2.5	Medium
Poultry	1.5 to 6	1 to 4	0.5 to 3	Medium to fast
Sheep	2.2 to 3.6	0.3 to 0.6	0.7 to 1.7	Medium
Turkey	5	0.5	0.6 to 0.9	Medium to fast
Vermi-cast	1.86	3.61	1.60	Medium
Bat Guano*	5.5 to 12.3	5.62 to 14.8	1.68 to 2.94	Medium to fast
Bat Guano**	1.9 to 3.82	4 to 11	1.48 to 2.86	Medium to fast

*Bat guano from Lonar crater, ** Insectivorous bat

